

CLAIMS

We claim:

1. A fuel cartridge connectable to a fuel cell comprising:
 - an outer casing and an inner flexible liner containing fuel for the fuel cell, wherein the inner flexible liner comprises an insert disposed inside the inner liner to facilitate the transport of fuel from the cartridge to the fuel cell.
2. The fuel cartridge of claim 1, wherein the insert is integral with the walls of the liner.
- 10 3. The fuel cartridge of claim 2, wherein the integral insert comprises a plurality of ribs.
4. The fuel cartridge of claim 1, wherein the insert comprises a plurality of ribs.
5. The fuel cartridge of claim 4, wherein some of the ribs are substantially rigid.
- 15 6. The fuel cartridge of claim 4, wherein some of the ribs are flexible.
7. The fuel cartridge of claim 4, wherein the ribs are flexible.
- 20 8. The fuel cartridge of claim 1, wherein the insert is a foam insert.
9. The fuel cartridge of claim 1, wherein the insert comprises a mesh.
10. The fuel cartridge of claim 1, wherein the insert comprises a plurality of particles.
- 25 11. The fuel cartridge of claim 10, wherein the particles comprise jacks.
12. The fuel cartridge of claim 10, wherein the particles comprise spheres.
- 30 13. The fuel cartridge of claim 10, wherein the particles are connected to each other.

14. The fuel cartridge of claim 10, wherein the inner liner is connected to a shut-off valve and the fuel is transported through the shut-off valve to the fuel cell.

5 15. The fuel cartridge of claim 1, wherein the inner liner is connected to a shut-off valve and the fuel is transported through the shut-off valve to the fuel cell.

16. The fuel cartridge of claim 15, wherein the shut-off valve is disposed within a nozzle connected to the outer casing.

10 17. The fuel cartridge of claim 1, wherein the outer casing is substantially rigid.

18. The fuel cartridge of claim 1, wherein the outer casing has an internal structural support.

15 19. The fuel cartridge of claim 1, wherein the outer casing is flexible.

20. The fuel cartridge of claim 1, wherein the outer casing is sealed.

21. The fuel cartridge of claim 1, wherein the outer casing has an open structure.

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22. The fuel cartridge of claim 21, wherein the open structure is covered with a gas permeable, liquid impermeable membrane.

25 23. The fuel cartridge of claim 21, wherein the open structure is covered with a liquid absorbent filler material.

24. The fuel cartridge of claim 21, wherein the outer casing is a mesh.

30 25. The fuel cartridge of claim 21, wherein the outer casing defines at least one hole thereon.

26. The fuel cartridge of claim 25, wherein the hole is covered with a gas permeable, liquid impermeable membrane.

27. The fuel cartridge of claim 25, wherein the hole is covered with a liquid absorbent filler
5 material.

28. The fuel cartridge of claim 25, wherein the hole is covered with a lid.

29. The fuel cartridge of claim 1, wherein the cartridge further comprises a first
10 unidirectional relief valve disposed on the outer casing, said first relief valve intermittently allows air to enter the cartridge to prevent a partial vacuum from forming within the cartridge.

30. The fuel cartridge of claim 29, wherein the first relief valve is covered by a gas permeable, liquid impermeable membrane.

15 31. The fuel cartridge of claim 29, wherein the first relief valve is covered by a liquid retaining filler material.

32. The fuel cartridge of claim 29, wherein the first relief valve is a poppet-type valve.

20 33. The fuel cartridge of claim 1, wherein the fuel is converted to electrical current in the fuel cell and at least one of the gas and liquid byproducts produced in the fuel cell is transported to an interior space between the outer casing and the inner liner in the cartridge.

25 34. The fuel cartridge of claim 33, wherein the cartridge further comprises a second unidirectional relief valve disposed on the outer casing, said second relief valve intermittently allows gas from inside the cartridge to vent.

30 35. The fuel cartridge of claim 34, wherein the second relief valve is covered by a gas permeable, liquid impermeable membrane.

36. The fuel cartridge of claim 34, wherein the second relief valve is covered by a liquid absorbent filler material.

37. The fuel cartridge of claim 34, wherein the second relief valve is a poppet-type valve.

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38. The fuel cartridge of claim 1, wherein the cartridge further comprises an energy-storing device to compress the inner liner.

39. The fuel cartridge of claim 38, wherein the energy-storing device is a compressed spring.

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40. The fuel cartridge of claim 38, wherein the energy-storing device is a compressed foam.

41. The fuel cartridge of claim 38, wherein the energy-storing device is compressed gas.

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42. The fuel cartridge of claim 41, wherein the compressed gas is butane, n-butane or propane.

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43. The fuel cartridge of claim 1 is further connectable to a fuel refilling container.

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44. The fuel cartridge of claim 1, wherein the inner liner is compressed by an external energy-storing device.

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45. The fuel cartridge of claim 1, wherein a movable wall is slidingly disposed within the outer casing.

46. The fuel cartridge of claim 45, wherein the movable wall comprises a seal.

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47. The fuel cartridge of claim 46, wherein the seal comprises a wiper that presses against the outer casing to form a seal with the outer casing.

48. The fuel cartridge of claim 45, wherein the outer casing is coated with a friction reduction film.

49. The fuel cartridge of claim 48, wherein the friction reduction film is
5 polytetrafluoroethylene.

50. The fuel cartridge of claim 1, wherein the inner liner is colored.

51. A fuel cartridge connectable to a fuel cell comprising:
10 an outer casing, an inner flexible liner and an interior space defined between the outer casing and the inner flexible liner, wherein fuel for the fuel cell is contained in the interior space and wherein the fuel is transported to the fuel cell for conversion to electrical current in the fuel cell and the byproduct produced is stored the flexible liner.

15 52. A fuel cartridge connectable to a fuel cell comprising:
an outer casing, an inner flexible liner containing fuel for the fuel cell, and an interior space defined between the outer casing and the inner flexible liner, wherein the fuel is transported to the fuel cell for conversion to electrical current in the fuel cell and at least one of the gas and liquid byproducts produced in the fuel cell is transported to the interior space,
20 wherein the outer casing is in fluid communication with a unidirectional relief valve, such that at a predetermined pressure within the cartridge the gas is vented through the relief valve.

53. The fuel cartridge of claim 52, wherein the relief valve is a poppet-type valve.

25 54. The fuel cartridge of claim 52, wherein the relief valve is covered by a gas permeable, liquid impermeable membrane.

55. The fuel cartridge of claim 51, wherein the outer casing has an open structure.

30 56. The fuel cartridge of claim 55, wherein the open structure is covered with a gas permeable, liquid impermeable membrane.

57. The fuel cartridge of claim 55, wherein the open structure is covered with a liquid absorbent filler material.

5 58. The fuel cartridge of claim 55, wherein the outer casing is a mesh.

59. The fuel cartridge of claim 55, wherein the outer casing defines at least one hole thereon.

10 60. The fuel cartridge of claim 59, wherein the hole is covered with a gas permeable, liquid impermeable membrane.

61. The fuel cartridge of claim 59, wherein the hole is covered with a liquid absorbent filler material.

15 62. The fuel cartridge of claim 59, wherein the hole is covered with a lid.

63. A relief valve comprising a biased valve head cooperating with a valve seat and adapted for use with a fuel cartridge, wherein the fuel cartridge is connectable to a fuel cell and wherein 20 when fuel is withdrawn from the fuel cartridge and the internal pressure of the cartridge reaches a predetermined level, the valve head moves away from the valve seat to intermittently allow air to enter the fuel cartridge to raise the internal pressure of the cartridge.

64. The relief valve of claim 63, wherein a membrane covers an opening of the valve.

25 65. The relief valve of claim 64, wherein the membrane is a gas permeable membrane.

66. The relief valve of claim 65, wherein the membrane is a liquid impermeable membrane.

30 67. The relief valve of claim 64, wherein the opening is an entrance opening of the valve.

68. The relief valve of claim 64, wherein the opening is an exit opening of the valve.

69. The relief valve of claim 63, wherein a liquid absorbent filler material covers an opening of the valve.

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70. The relief valve of claim 63, wherein the fuel cartridge comprises an outer casing and the relief valve is disposed on the outer casing.

71. The relief valve of claim 63, wherein the fuel cartridge comprises an outer casing and
10 an inner flexible liner, and the relief valve is disposed on the outer casing.

72. A relief valve comprising a biased valve head cooperating with a valve seat and adapted for use with a fuel cartridge, wherein the fuel cartridge is connectable to a fuel cell and wherein when internal pressure of the cartridge reaches a predetermined level, the valve head moves
15 away from the valve seat to intermittently vent gas from the fuel cartridge to lower the internal pressure of the cartridge.

73. The relief valve of claim 72, wherein a membrane covers an opening of the valve.

20 74. The relief valve of claim 73, wherein the membrane is a gas permeable membrane.

75. The relief valve of claim 74, wherein the membrane is a liquid impermeable membrane.

76. The relief valve of claim 72, wherein a liquid absorbent filler material covers an
25 opening of the valve.

77. The relief valve of claim 72, wherein the fuel cartridge comprises an outer casing and the relief valve is disposed on the outer casing.

30 78. The relief valve of claim 77, wherein the fuel cartridge further comprises an inner flexible liner disposed within the outer casing.

79. The relief valve of claim 72, wherein at least one of the gas and liquid byproducts of the fuel cell is transported to the fuel cartridge.

5 80. A fuel cartridge connectable to fuel cell comprising:
an outer casing and a movable wall slidably disposed within the outer casing, wherein
the movable wall forms a seal with the outer shell, wherein an energy-storing device pushes the
movable wall to transport fuel from the cartridge to the fuel cell.

10 81. The fuel cartridge of claim 80, wherein the energy-storing device is a compressed
spring.

82. The fuel cartridge of claim 80, wherein the energy-storing device is compressed foam.

15 83. The fuel cartridge of claim 80, wherein the energy-storing device is compressed gas.

84. The fuel cartridge of claim 83, wherein the compressed gas is butane, n-butane or
propane.

20 85. The fuel cartridge of claim 80, wherein the seal comprises a wiper, said wiper presses
against the outer casing to form the seal.

86. The fuel cartridge of claim 80, wherein the fuel is stored in a flexible inner liner and
wherein the flexible inner liner is pushed by the energy storing device.

25 87. The fuel cartridge of claim 80, wherein the fuel cartridge further comprises a
unidirectional relief valve disposed on the outer casing, said relief valve intermittently allows
air to enter the cartridge to prevent a partial vacuum from forming within the cartridge.

30 88. The fuel cartridge of claim 87, wherein the relief valve is covered by a liquid absorbent
filler material.

89. The fuel cartridge of claim 87, wherein the relief valve is covered by a gas permeable, liquid impermeable membrane.

5 90. The fuel cartridge of claim 87, wherein the relief valve is a poppet-type valve.

91. The fuel cartridge of claim 80, wherein the outer casing is coated with a friction reduction film.

10 92. The fuel cartridge of claim 91, wherein the friction reduction film is polytetrafluoroethylene.

93. A fuel cartridge connectable to fuel cell comprising:
an outer casing and a movable wall slidably disposed within the outer casing, wherein
15 the movable wall forms a seal with the outer casing, and wherein an energy-storing device positioned outside of the cartridge pushes the movable wall to transport fuel from the cartridge to the fuel cell.

94. The fuel cartridge of claim 93, wherein the seal comprises a wiper disposed on the
20 movable wall and wherein said wiper presses against the outer casing to form a seal with the outer shell.

95. The fuel cartridge of claim 93, wherein the energy-storing device is positioned in the
fuel cell.

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96. The fuel cartridge of claim 93, wherein the energy-storing device is positioned in an electronic device powered by the fuel cell.

97. The fuel cartridge of claim 93, wherein the energy-storing device is a compressed
30 spring.

98. The fuel cartridge of claim 93, wherein the energy-storing device is compressed foam.

99. The fuel cartridge of claim 93, wherein the energy-storing device is compressed gas.

5 100. The fuel cartridge of claim 93, wherein the compressed gas is butane, n-butane or propane.

101. The fuel cartridge of claim 93, wherein the outer casing is coated with a friction reduction film.

10 102. The fuel cartridge of claim 101, wherein the friction reduction film is polytetrafluoroethylene.

103. A fuel cartridge connectable to fuel cell comprising:
15 an outer casing and a flexible inner liner containing fuel, wherein an energy-storing device positioned outside of the cartridge pressurizes the flexible inner liner to transport fuel from the cartridge to the fuel cell.

104. The fuel cartridge of claim 103, wherein the energy-storing device is positioned in the
20 fuel cell.

105. The fuel cartridge of claim 103, wherein the energy-storing device is positioned in an electronic device powered by the fuel cell.

25 106. The fuel cartridge of claim 103, wherein the energy-storing device is a compressed spring.

107. The fuel cartridge of claim 103, wherein the energy-storing device is compressed foam.

30 108. The fuel cartridge of claim 103, wherein the energy-storing device is compressed gas.

109. The fuel cartridge of claim 103, wherein the compressed gas is butane, n-butane or propane.

110. The fuel cartridge of claim 103, wherein a movable wall is disposed between the
5 flexible inner liner and the energy-storing device.